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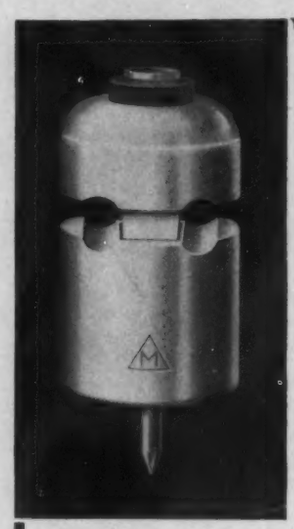

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FEASIBILITY OF ELECTROCHEMICAL INDUSTRIES AT THE DALLES, OREGON

BY O. F. STAFFORD.

(This comprehensive summary of Western electrochemical possibilities is a part of the general report on the Columbia River Power Project, at The Dalles, Oregon, which has been appearing in these columns during the past few months. The author is professor of chemistry at the University of Oregon, Eugene, Oregon.—The Editor.)

Introductory.

The proposal to utilize power from a hydroelectric development at The Dalles, Oregon, for electrochemical industries at once raises the usual economic problems of costs and markets, the solution of which must determine whether or not such industries may possibly exist as commercially successful enterprises. In the pages which follow there will be given the results of an investigation into the factors necessary for the solution of these problems for this particular case together with the conclusions which fairly may be drawn from them.

In securing the necessary data, recourse has been had to seemingly dependable published material wherever it might be found, this outline information being supplemented by many conferences and much correspondence with persons in position to give the desired facts. There was also secured a number of co-operative constributions from men in the government departments at Washington who are able to speak authoritatively upon certain aspects of the general problem.

Due acknowledgment is to be made at this time as to the helpfulness and value of these contributions.

Rjukan Chemical Works, Norway, where 80,000 tons of Lime Nitrates are Annually Produced by the Birkeland-Eyde Process of Fixing Atmospheric Nitrogen Electrically.

They were included in the original report to the project authorities, it may be said, just as they were submitted by the several contributors, but since some of them overlap the subject matter of others to a considerable extent it has been decided that for the purposes of the present article it is better to abstract these contributions and incorporate them in unified form into a general discussion.

The articles as originally contributed were as follows:

Dr. Frank K. Cameron, chief chemist Bureau of Soils, "Hydroelectric Power and the Manufacture of Nitrogen and Phosphorus Fertilizer."

W. H. Waggaman, chemist Bureau of Soils, "Hydroelectric Power with Reference to the Utilization of Western Phosphate Rock."

Messrs. E. F. Burchard and G. F. Loughlin, U. S. Geological Survey, "Northwestern Limestone Deposits."

W. C. Phalen, U. S. Geological Survey, "Western Saline Deposits."

W. H. Ross, chemist U. S. Bureau of Soils, "The Application of Hydroelectric Power to the Commercial Utilization of Potash-Bearing Minerals."

The scope of the investigation assigned to the writer includes all industries producing chemicals by the use of electricity excepting, however, those producing metals and alloys, the investigation of which formed a separate assignment handled by Messrs. D. A. Lyon and R. M. Keeney, of the United States Bureau of Mines. Since the purpose of the investigation was primarily to ascertain which of these industries, if any, could so exist as to absorb large blocks of power, no account is taken of a number of processes, which by reason of very restricted consumption of their products, obviously could not be considered as possible power consumers however successfully they might operate in a western location. Within these limitations the remaining industries to be considered are those producing abrasives, caustic and bleach, calcium carbide, chlorates, cyanides, graphite, nitrogen compounds and phosphorus compounds.

For the production of these substances relatively few raw materials are necessary, a given raw material in some instances being common to two or more products. For this reason the subject of raw material is given a preliminary consideration in this report, the discussion of manufacturing costs and market possibilities in the several industries then following under their respective headings. The particular raw materials in question are power, carbon, limestone, silica, salt, potassium, chloride and phosphate rock.

Raw Materials.

Power. Electrical energy is, of course, itself peculiarly one of the necessary "raw materials" in any electrochemical industry. The costs of electrical energy at The Dalles under the proposed project are indicated in detail in the section of this report made by the project engineer. Since the first task of the project authorities would be to utilize the primary power to be produced, all discussions to follow will be based upon the estimated cost of primary power at the generator terminals with 100 per cent load conditions at $9 per horsepower-year. If the energy were transmitted to Portland in order to secure to an industry the advantages of deep water transportation, the cost would be considerably higher. The distance is 85 miles; reckoning all costs attending transmission and transformation, the probable cost of energy at Portland may be taken as $13 per horsepower-year, this figure depending, of course, upon the amount of energy transmitted, any figure approximating the one given representing the transmission of a very large block of power.

It may be said, incidentally, that in some instances this higher cost of power might well be met in order to save the transportation of raw materials up to The Dalles and the finished product back again. This would be particularly the case in the soda and bleach industry, for example, where the tonnage of materials to be taken to the plant and back is large with respect to the consumption of electrical energy per ton of product. In the discussions following, however, this possible advantage in any case is not considered, the assumption being uniformly that the industry is to be located at The Dalles.

The discussion of power costs in connection with proposed industries at The Dalles is obviously incomplete without some reference to power possibilities which might be taken up and utilized by competitive concerns elsewhere. The subject is altogether too large, however, to be treated exhaustively at this time and the most that can be said is that in all probability the development of this power would overshadow all other possibilities in the Pacific Northwest for a long time to come, as far as electrochemical industries might be concerned. It is the prevailing opinion that other smaller powers might be developed at much the same cost per capacity unit but that they would compete with so large a power once developed is not probable.

It is not the power situation in the West, therefore, which would affect the marketing of the power from the project at The Dalles for electrochemical purposes so much as the fact that in the East, where the markets for electrochemical products actually are, there is still much more power to be had at unit costs not impossibly higher than the cost at The Dalles. Power being but one item in the total cost of producing chemicals by electricity, any other advantage in an eastern locality, such as nearness to market, would permit the Eastern manufacturer to pay a comparatively high price for his power and still be even in his final costs of production. It is for this reason that the water powers in the southeastern states and in Canada, and even in Norway, stand as the obstacles to the utilization of Western hydroelectric power. It is not beyond the bounds of reason to assert that even steam-electric installations, using modern turbine units at places in the East easily served by cheap coal, might be commercially more economical sources of power for electrochemical use than western hydroelectric power.

Carbon. Both wood and coal stand as the potential sources of carbon in the Northwest.

The large area of standing timber in this territory, together with the magnitude of the lumbering industry, indicates the possibility of securing eventually a dependable supply of carbon in the form of charcoal by the utilization of the wood now wasted in the operation of logging and milling, all provided that the cost of producing this form of carbon is not greater

than the price at which high-grade coke may be obtained.

The waste in logging is especially great. At the same time the conditions for the inexpensive assembling of this waste material are particularly good, since all of the unsound trees are felled anyway under approved logging methods and together with the refuse from the sound ones could be yarded simultaneously with the bringing in of the logs to the point of loading. Actual costs for wood cut ready for charging into a retort or kiln are estimated to be $1.25 per cord if obtained in this way. By charring the wood on the spot the product could be carried to regular transportation lines over the logging railways, and so to market, at minimum costs.

Under such a plan it might be possible to secure charcoal without by-products recovery at a figure not greatly exceeding $7 per ton at the kiln or perhaps $8 per ton delivered at the electrochemical plant. This estimate assumes costs of production only, no profits being allowed for.

It is known that in the South charcoal is sold to the iron industry at $6 per ton, the charring process, however, being attended by by-products recovery. It happens, however, that the merchantable by-products from the distillation of Douglas fir, the wood most abundantly available in the Northwest, are not as great in yield as from equal quantities of selected southern wood, so that charcoal-making in the Northwest with by-product recovery has always been an industry hanging tantalizingly near the dividing line between the commercially profitable and unprofitable without ever getting comfortably over into the profitable side.

In spite of this discouraging history, however, it is not without the bounds of possibility that by-products recovery plants might be attached to simple forms of kilns or retorts set up as suggested above, right at the source of the raw materials, and yield a sufficient margin above operating costs to place the whole charring industry upon an independently profitable footing.

It appears, therefore, that the very best that might be expected in the way of a carbon supply from wood is a minimum price of $8 per ton for charcoal delivered at the electrochemical plant.

The coal supply of the Northwest is represented by deposits, varying extremely in quality, extending from Coos Bay, Oregon, to Alaska.

The Coos Bay deposits, as well as some of those of western Washington, are sub-bituminous, non-coking coals which could have only limited use in electrochemical industries directly. These coals vary in their heating powers from 9000 to 14,000 B.t.u. per pound and cost from $1.40 to $2.50 per ton at the mine. The average distance from the western Washington mines to The Dalles may be taken as 260 miles with a possible eventual rate of $1.30 per ton. The limited quantities of this cheap coal which might be used for steam, etc., could therefore be had at about $4 per ton delivered.

Coal of suitable quality for coking is found in at least two localities in Washington. Coking operations so far have been confined to the Eilkeson-Carbonado field in Pierce county, although tests made by the U. S. Geological Survey at Denver have also established the coking qualities of the coal from the northern part of the Roslyn field in Kittitas county. The coke from Washington, while in general use in the Northwest for foundry and smelting purposes, is not of suitable quality for the making of electrochemical products. It consequently can receive no further consideration in this report.

There are at least three coal fields lying across the Canadian boundary line which yield coke of acceptable quality for the purposes in question.

One of these is at Crows Nest Pass, a point upon the boundary line between British Columbia and Alberta. The field is upon the line of the Canadian Pacific Railway and is also tapped by a branch of the Great Northern, this latter road making possible a direct haul of 600 miles to The Dalles. This coke is said to sell currently at from $6 to $7 per ton at the point of production. It is not apparent, however, why profitable production of coke might not be carried on at Crows Nest Pass with sales at $4 or even less per ton were the demand steady and large. Freight upon such an output to The Dalles should not exceed $3, making a possible minimum of $7 per ton delivered at the industrial site under discussion.

The other two sources of suitable coke are upon Vancouver Island at Ladysmith and Union Bay, respectively. Current prices for coke in these localities are much the same as at Crows Nest Pass, the lowest actual quotations accessible being around $7 per ton at tidewater. Freight to Portland has been offered at $1 per ton, making a possible price at The Dalles slightly under $9 per ton under present conditions. Again, however, it must be the case that with a large and steady output of coke a reasonable profit should be made in the Vancouver Island collieries with a much lower selling price, a reasonable minimum being estimated as $4 per ton. Were such a figure ever made the price of coke at The Dalles might be somewhat less than $6 per ton.

Coal from Alaska eventually should figure in the cost estimates of coke for industries in the Northwest, since the Alaska fields are now being provided with transportation lines and the quality of the product would be undoubted. With the development of the coal producing situation in Alaska industrially there must at some time come about a condition which will compare with coal and coke producing conditions in the eastern United States. It is possible therefore to make an approximate estimate of what may be expected in time in the way of prices to be obtained for Alaskan colliery products.

Using statistical coking and transportation costs based upon present eastern conditions, but allowing the coal miner a somewhat higher price than the statistical eastern price, the cost analysis appears as follows:

1½ tons coal at $2.20 per ton	$3.30
Expenses and profits of coking	.60
Freight to ocean shipping point	.65
Freight to Portland (about 1500 miles)	1.00
Trans-shipping at Portland	.15
Freight—Portland to The Dalles	.45
	$6.15

Such a cost analysis would apply, of course, only to conditions involving a large and steady output, but it is also true that the figure given must be a near ap-

proximation to the minimum cost at which Alaska coke may ever be delivered.

Alaska coal and coke, as a matter of fact, must always be at a disadvantage commercially compared with these same things when produced upon Vancouver Island. Industrial conditions generally should be very much the same at the two locations, so that actual production costs should be alike in the long run. The greater distance to the Alaska fields will always be a handicap, therefore, which under close competitive conditions would seriously affect the welfare of the Alaska coal industry. Upon the other hand the price of coal and coke from the Vancouver Island coal fields probably will never sink to a point representative of usual mining and coking profits until forced to do so by competition from Alaska.

With the Panama Canal in operation there remains the possibility of securing eastern coke for use at The Dalles. It is still too early for rates by ocean from the Atlantic coast to have reached the low figures hoped for and freely predicted when the canal was being promoted, so that any estimate involving ultimate rates is accompanied by great uncertainty. Applying the ton-mile rates attending the movement of coal and ore upon the Great Lakes would give for Portland a rate of about $4 per ton from New York. Eastern coke varies in price, the statistical average for 1912 being $2.55 at the points of production. A rounded figure for the price on board vessel at eastern seaport would therefore be $3 per ton, making the price on vessel at Portland $7. Predictions have been made that coal could be moved from the Atlantic to the Pacific seaboards for as little as $2.50 per ton. Were a freight rate of $3 finally to be effective for coke the price of the eastern article might possibly be as little as $6, say, at Portland.

European coke of high grade has been sold in Portland for as low as $8 per ton, and doubtless with the Panama canal in operation this price might be reduced somewhat. Quotations have also been had upon coke from the Chinese colliery at Pinghsiang at $7 per ton f.o.b. Portland.

To summarize:

	Maximum.	Minimum.
Charcoal	$10.00	$8.00
Crows Nest Pass	9.00	7.00
Vancouver Island	8.00	6.00
Alaska	8.00	6.00
Chinese	7.00	7.00

It is evident, therefore, that a supply of carbon of good quality might be obtainable at The Dalles in quantity, at not to exceed $8 per ton, with the possibility that in the course of time not more than $6 would be paid. These are the figures to be compared with an average price of perhaps $3.75 for carbon at Niagara Falls.

It should be stated also that in some instances anthracite coal is a form of carbon preferred for electrochemical processes. The cost of such coal at The Dalles could scarcely be less than the cost of coke if brought from the East. Anthracite from Alaska, if used upon a large scale, should be available at The Dalles eventually at a cost of about $5 per ton.

Limestone and lime. The whole country adjacent to the Columbia River in Oregon and southern Washington is covered with a heavy deposit of basaltic rock with practically an entire absence of limestone in any form. In Oregon there are significant deposits of limestone in the extreme northeast and southwest corners of the state, neither of these localities being accessible, however, without the expense attending a long haul over at least one mountain range in each case. The distance to the southwestern deposits is so great that no further account need be taken of them in the present discussion.

In the northeastern field there are two possibilities, one in Wallowa county and the other in Baker county near Huntington. Both have railway transportation directly to The Dalles and the distances are nearly the same, in round figures, 300 miles. The haul of lime or limestone, insofar as railway grades are concerned, might be lighter from the Wallowa deposits than from those in Baker county. There is the further possibility that lime might be produced more cheaply also at the former locality than at the latter on account of the greater availability of wood for burning. In either case the statistical freight rate of 5 mills per ton mile would make an approximate transportation cost of $1.50 per ton to The Dalles; quarrying cost may be taken at 40 cents per ton, loading 10 cents, the price delivered therefore being $2 per ton. If the lime were burned before shipment the cost would be $4.30 at the kiln, estimating that there would be used one-half cord of wood at $3 per cord and two tons of limestone to the ton of product, the other costs of production being taken as $2 per ton. Adding to the above total the transportation estimate of $1.50 per ton, the cost at The Dalles would be $5.80.

There is a deposit of limestone near Roseburg, Douglas county, Oregon, of sufficient size and quality to furnish a supply of limestone for the industries under consideration. The stone could be mined at low cost, since the deposit is so exposed that a large output could be loaded directly into the cars by gravity. The distance to The Dalles is 285 miles, or practically the same as from the eastern Oregon deposits, and it is safe to say that the delivery costs of either lime or limestone would therefore differ but slightly from the above estimate.

Some high grade limestone deposits are also to be found upon the Snake River just above the mouth of the Grande Ronde. The fact that the Snake is tributary to the Columbia suggests that limestone from these deposits might be transported to The Dalles by barge lines at a low transportation cost. An objection to this plan is to be found in the navigation difficulties attending transportation of any kind upon the Snake River. The stream is not navigable for four months of the year, and at other times a number of bad rapids are to be overcome, making any dependable use of the river a matter of such uncertainty, in the opinion of men in position to know all of the circumstances, that the plan to secure a supply of lime or limestone from this source is not to be reckoned as feasible.

Much the same obstacle as in the case just discussed exists as far as limestones upon the Columbia near the Canadian boundary in Washington may be concerned. The Columbia is not adapted to use as a dependably navigable stream at this time to so great a distance.

In western Washington, however, as well as at intervals along the coast line well into Alaska, limestones are to be found which are of suitable quality. Some of these are upon islands in Puget Sound, the well-known quarries upon San Juan and Orcas Islands being examples, while others are inland or upon Vancouver Island.

The distance by water from these Puget Sound deposits to Portland is about 375 miles, a part of which is upon the open sea. Barge transportation upon a sufficiently large scale might be expected to handle limestone at a figure around fifty cents per ton, and with the possibility that the barges might be so built as to be taken on up the Columbia to The Dalles the total cost of delivery including the unloading should be well under a dollar a ton. The cost of the limestone on board barge at quarry should not be greater than 60 cents per ton so that the price delivered at The Dalles would be near $1.50.

The transportation of burned lime by barge is said to offer certain difficulties which would make the cost per ton for the carriage alone greater than for a ton of limestone. Without definite knowledge regarding what this difference in freight cost would be it is impossible to predict the advantages of burning the lime at the quarry rather than at The Dalles. Expenses of burning the lime should be much the same at either locality so that the question eventually to be determined would be whether one ton of lime could be moved more cheaply than the two tons of limestone necessary to make it.

Assuming that the lime were burned at The Dalles with wood at $3 per cord, limestone $1.50 per ton and other expenses $2 per ton of lime produced, its cost at the kiln would be near $6.50 per ton. If lime could be moved at the same rate per ton as limestone the cost of lime burned at the quarry and delivered at The Dalles might be $5 per ton. Lime burned at the quarry could be delivered at The Dalles by rail, with a freight rate of 5 mills per ton mile, for about $5.50.

It seems evident, therefore, that a supply of lime for the industries in question if taken upon a considerable scale, could be assured at a figure not exceeding $6 per ton. It is of interest to state, in this connection, that high grade burned lime is reported delivered to Niagara Falls electrochemical factories at $4.50 per ton.

Salt. Salt deposits in the West are abundant enough, the recent investigations having for their purpose the location of possible potash saline deposits indicating that about 200 deposits of one kind or another are available for salt production. Of all of these, however, relatively few are near enough to the coast or to transportation lines of any kind to permit the delivery of salt to the coast markets at prices comparable with the prices of salt in the East. Salt ledges are known from which it would be possible to load cars by very cheap quarrying processes at costs which could scarcely be in excess of a dollar a ton, yet by the time expenses of transportation to the coast, wharfage, handling, etc., were paid the price on board coastwise schooner would be near three dollars a ton. Even the exploitation of such salt lake deposits as that of Searles Lake, which would be worked primarily for their values in potash, borax and soda, and where the by-product salt might possibly well be given away by the operators, the costs attending the movement of the salt to the coast and loading upon a vessel would be above two dollars a ton.

It is this situation which has made possible the growth of a large solar salt industry in California. The beds are located for the greater part upon San Francisco Bay in Alameda and San Mateo counties, but solar salt is also made near Long Beach, Los Angeles county, and upon San Diego Bay. The processes yield salt at a cost which seems to have established a general value of $2.50 per ton for the crude product in the stock pile at the works. Handling, barge tolls, and a schooner rate as at present of $1.50 per ton to Portland will bring the price delivered at The Dalles inevitably up to near $6 per ton. This figure might be lowered by a dollar or so were cheap salt eventually available at some such place as Searles Lake, the product being taken out by rail to San Pedro and by schooner to Portland.

The string of salt deposits referred to above, and of which Searles Lake is a member in the south, extends as far north as central Oregon, being represented there by two notably large salt lakes known as Lake Abert and Sumner Lake. These two saline deposits are within 300 miles of The Dalles and are therefore of direct interest in connection with the proposed power development because of their nearness. There are at this time no transportation lines between the lakes and The Dalles, however, so that all proposals of use of this salt at The Dalles must be contingent upon the future development of carrying facilities.

To obtain salt from the lakes in question is more than a mere matter of solar evaporation, however, since the saline content of the water is more than half sodium carbonate, considering the two lakes together. Salt production, therefore, would be accompanied by soda production also, the sale of both products being undoubtedly essential to the commercial success of any attempt to utilize these brines. The western soda market is very limited, it must be noted, and any scheme for transporting this commodity from this locality to the eastern markets in competition with Solvay soda is not to be thought of. Not even the recovery of potash salts, which exist in small amount in Summer Lake, nor the advantages of transporting the concentrated brine to The Dalles by pipe line, as has been proposed, would be sufficient to place the salt-soda industry at these lakes into a profitable condition until the industrial situation upon the coast generally advances to the point where the soda can be marketed.

The possibility of salt from an eastern source is precluded by the transportation charge. The most available eastern source probably would be Louisiana. Rock salt could be loaded upon ocean vessels relatively cheaply at Gulf ports, but with a distance of 5000 miles to Portland the freight would absorb any advantage over the somewhat higher stock pile figure at the California solar beds.

It follows, therefore, that a salt-consuming industry located at The Dalles might expect a supply of salt at

a figure eventually around $6 per short ton, the source being either the solar beds of California or one of the inland deposits of the same state such as that at Searles Lake. The price of salt delivered to the electrochemical industries at Niagara Falls is reported to be $2.50 per ton.

Silica. Crude forms of silica are abundant in the Pacific Northwest in the unlimited amounts of dune sand to be found upon the coast. For purposes where an impure silica might suffice, this sand would serve after a preliminary purification involving the magnetic separation of iron minerals.

Very pure silica deposits are reported at various points along the inland water-way leading from Puget Sound to Alaska. A deposit is also reported from eastern Washington, near Spokane, which appears to be of excellent quality. It is probable that silica from this locality could be delivered at The Dalles for about $2.50 per ton.

Eastern Oregon has a number of deposits of infusorial earth of good quality as far as physical properties are concerned but which carry notable amounts of iron and alumina as impurities. One of these is located upon the Des Chutes River and only a few miles from the railroad at a distance of about 100 miles from The Dalles. It should be possible to deliver supplies of this material to the industrial site at not to exceed $3 per ton.

Potash. Potassium chloride is of interest in this report for the reason that it is a necessary raw material for the manufacture of potassium chlorate and finds an important application in the making of mixed fertilizers.

As is well enough known, the potash market is supplied from certain unique deposits in Germany and Austria where conditions for the production of potash salts are so exceptionally favorable that under free marketing conditions all sales the world over are under the absolute control of the interests operating these sources.

This situation, amounting to complete dependence of the United States upon a foreign locality for a commodity vitally necessary to agriculture, has led to extensive investigations both by the Federal Government and by private interests into the possibilities of securing domestic sources of potash. These investigations have shown that it is possible to obtain potash from within the territory of the United States.

The most promising of the sources of supply are from leucite rock, alunite, certain western saline deposits, and from Pacific Ocean kelps. Projects are under way for the production of potash from the last three of these, certainly. How successfully they may be able to compete with German potash eventually is altogether a matter for future determination.

In any event it is unlikely that these industries will be able more than to hold their own with the powerful foreign competition they will have to meet. With this probability it is to be expected that potash supplies will cost in the future about the same as in the past which, in cargo lots at Pacific Coast ports means a figure for potassium chloride ranging around $40 per short ton.

(To be continued.)

WATERPOWERS NOT A LIABILITY.

BY C. E. GRUNSKY.

(This communication corrects an imputation made by the California Railroad Commission that Mr. Grunsky deduced a negative value for water powers in the San Joaquin rate decision, as these unfavorable costs are not to be considered a measure of value. Furthermore, the author argues that "value" is not a proper basis for rate making.—The Editor.)

I am prompted by your publication of extracts from the recent decision of the California Railroad Commission in the San Joaquin Light & Power rate case, in your issue of April 29th, to submit a brief discussion thereof, in order that my views relating to the value of the water rights in question, may be made clear. I desire to premise my remarks by saying that I am not in sympathy with the program which makes the "present value" and the "rate-base" synonymous. I know that the courts insist that the starting point, the basis of the calculation, must be "present worth" when rates are to be fixed. But I believe that the valuation engineers and economists will yet succeed in making plain that "value" is not the proper starting point, so that the courts and the public service commissions may be permitted to cut loose from all consideration of value as the basis of rates, dealing only with investment, while yet keeping in view the value in excess of investment which the allowed earnings may create.

In the matter of the development of water power. I have only to emphasize that such development is of prime importance to society and, therefore, the public can afford to and should pay something therefor. The development should receive special encouragement and will be legitimate in many cases in which the energy obtainable from the water costs more than a like amount of energy developed by burning coal or oil. There should be a reward to the owner of the developed water power—within limits of course—for conserving natural resources. Society profits by the utilization of the water power and should consent to share with the water power owner a part of the unearned increment which he helps to create in the district in which he makes light and power available. The water right of an operating hydroelectric power plant should never be considered a liability, barring the exceptional case in which all matters, including the advantage to society, being considered, it is clearly apparent that the power development was premature and unwise. In every other case the investment deserves protection and the investor is entitled to fair compensation.

Commissioner Thelen in writing the decision in the rate case under consideration says: "It will be observed that Mr. Grunsky and Mr. Kenny both used the substitutional steam plant method but that one engineer, using this method, reports a large affirmative value for the corporation's water rights, while the other, using the same method, reports a large negative value." By using this language the commissioner makes it appear that I made the comparison of cost of developing power for the purpose of deducing therefrom the value of the water power and that I did report a large negative value. While it is true that the advantage in the matter of the cost at which energy can be produced for distribution was temporarily with

a substitutional steam plant—oil having been cheap at Bakersfield in 1913 and 1914—I did not use this fact as a basis for determining a large negative value. The deduction of a large negative value from my figures is the commission's deduction and not mine. I do not, and never have accepted the substitutional steam plant method as a dependable method of ascertaining the value of a water power.

Comparisons of power cost, generated in various ways, are legitimate, however, and deserve consideration. It is the kind of study which the engineer makes when he is called upon to advise his client whether or not to undertake a hydroelectric development.

The purtenancy of the comparison in this case, too, is apparent, because at the time that the development of power on the San Joaquin and on the Kern River was undertaken by the predecessors of the present owners, oil was worth about $1 per barrel. No oil well had yet been drilled in the Kern River oil field and the output of oil from a few wells at Coalinga and other points in the San Joaquin Valley was an almost negligible quantity. The total oil production of the state was at that time only about 1 per cent of the present production. Furthermore, the price of oil is now about 71 cents in Bakersfield, whereas during the two years 1913 and 1914, it was but little above 50 cents per barrel. The uncertain price of oil in the future and the uncertain life of the California oil fields condemns the use of the comparison for any conclusive determination of the value of the water power.

Any conclusion, whether based on the comparison of cost of power submitted by me or whether otherwise determined that the water rights of the San Joaquin Light & Power Corporation are a liability, would be unfair to the corporation and would deserve severe condemnation. The power development made by that corporation was timely and commendable and the corporation should get not only full protection of its investment but, in addition, a fair compensation for having made the power development.

The San Joaquin Light & Power Corporation, moreover, is to be commended for its frankness in placing before the commission an unfavorable comparison of the cost of generating power, at the then prevailing price of oil, which, as the decision shows, is discussed as though it had been offered as a measure of value, instead of being treated merely as an element for consideration in fixing the value which the earnings may be allowed to create.

In this connection the following quotation from my statement before the commission in the San Joaquin Light & Power rate case relating to the comparative of cost of steam and water power will be of interest:

"The fact that at present prices of oil at Bakersfield (about 50 cents a barrel) a substitutional steam plant has some advantages over the hydroelectric plant, if the investment is to yield a return of 8 per cent per annum, in no way reflects upon the business intelligence of those who initiated the enterprise of developing the water powers on the San Joaquin Kern and Tule rivers, nor upon that of those who added new features to the established plants. The question is not, whether under present conditions as they are known for the oil fields, with due regard to the fluctuating prices at which fuel oil can be obtained, the undertaking of a similar enterprise would today be a wise business venture, but whether, all circumstances considered, the owners of the property are not entitled to the same treatment they would have received if each step taken by them from time to time had been subjected to the scrutiny, and had received the approval of a public service commission.

"At the same required earnings to meet operating costs plus depreciation and interest on the invested capital, the investment in the hydroelectric plant would be advisable:

"(a) Because it is more dependable as a permanent investment. It is free from the uncertainty of continuing usefulness resulting from a possible advance in the price of oil and the limited life of the oil field.

"(b) Because the development of a water power is in line with the true conservation of natural resources. The water used for power is replenished by nature from year to year while oil or other fuel is available in a limited supply only.

"(c) Because, while it is true that the electric company is in no position to obtain compensation for the indirect benefits which its development and especially its reservoirs confer upon the general public, the storage of water which aids in equalizing stream flow is a feature of considerable importance by reason of the resulting increase of the stream flow during the period of low water, thus conferring benefits both upon those interested in irrigation, and other users of water, all of which aid in the developing of the country and in enhancing its prosperity and growth.

"As a general proposition, therefore, there can be no question that when the alternative plants must have substantially the same earning capacity in order to yield a fair return on the investment, the hydroelectric is the more desirable and its construction should be encouraged.

"Moreover, at the time that the first development of power on the San Joaquin River and on the Kern River was undertaken, in 1895, by the predecessors of the San Joaquin Light & Power Corporation, the price of oil was at about $1 per barrel and there was no supply of oil then available in California that would have even suggested a possible competition of steam power plants with the water powers of the Sierra Nevada streams. No such competition as hereinabove made could, at that time, have come into consideration at all."

The commission has apparently misinterpreted the purpose of a comparison of the cost of generating power. I did not, as already stated, report a large negative value of water rights and resent being made to appear as favoring the treatment of a water right of a successful operating power plant as a liability. Nevertheless, such studies as made by me in this rate case serve a good purpose in presenting a phase of the rate problem in its true light. They are, moreover, of the nature which must sometimes be employed when "strategic value" is to be demonstrated.

THE RHYME OF THE ELECTRIC RANGE.

The Cave-man ate his victuals raw,
Chewed mammoth's trunk and tiger's paw,
Ere, age by age, he nursed the flame,
That from the flashing lightning came.
That Babylonian cooked with wood,
That smoked his house and burned his food,
And drove him into sooty stews,
That roused an awful thirst for booze.
And later yet the Baron bold
Still could not win with sword or gold
The juicy chop or well-browned roast,
That never old King Coal could boast.
We've pinched his sceptre, you and I,
We've tamed the lightning 'neath the sky,
We win the prize, and save our change—
Make way for the electric range!

A NEW TRIANGULATION SIGNAL LAMP.

BY E. G. FISCHER.

State, county and city surveyors must look to the national government for the exact geographical positions upon which to base their respective surveys. The duty to establish and furnish these positions devolves upon the United States Coast and Geodetic Survey.

The geodesist determines astronomically with the greatest possible exactness the longitude and latitude of selected principal points, suitably distributed over the whole country. The geographical positions of the many places between these principal points required are ascertained most accurately and economically by means of what is called triangulation. A rough, preliminary or reconnaissance survey reveals those points which are intervisible and most desirable as to distance and other characteristics, to form the corners of connected triangles. From the measured length of one side of a suitably selected one of these triangles and the angles of all the interconnected ones, the exact latitude and longitude of each point is computed.

Though the general principle employed in the measurement of those angles is the same as that applied in the survey of a railroad, a farm, etc., the great distance between the points, varying between ten and a hundred miles or over, requires, not only the use of specially large and refined instruments, but also a special means of making the point visible to the observer. This latter is now done, in day time, by reflecting sun light to the observer from a mirror placed accurately over the point, and at night by means of a specially constructed acetylene lamp.

It is apparent that distances of the magnitude mentioned can be penetrated by either means only under favorable weather conditions, and that many days during a season are lost even when the atmosphere is only slightly clouded by smoke, fog, etc. As the expense to maintain the party, which amounts to from $50 to $60 per day, goes on whether observations are made or not, it was thought that advances in illuminating devices made since the lamp now used was adopted might be utilized to increase considerably the intensity of the light directed to the observer, and thereby increase the number of observing nights.

Experiments made with calcium light produced by the oxy-acetylene flame showed this form of illumination to be impracticable by reason of cost and bulkiness of the apparatus necessary.

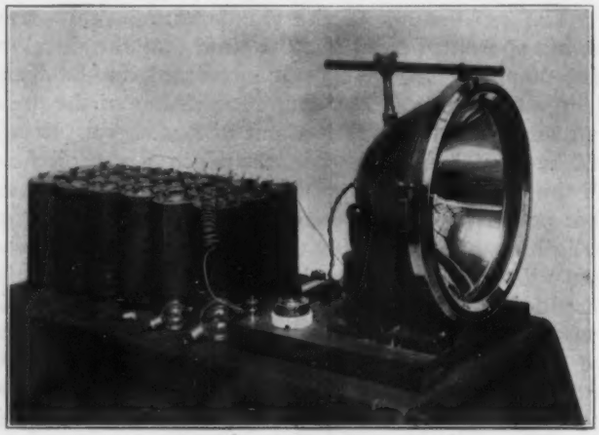
The storage cell was studied with the view of using electricity as a source of light. Its cost and weight and the difficulties connected with its maintenance were found to be too great. The electric generator with the necessary prime motor were carefully studied, tried experimentally and found to be too heavy for transporting to difficult stations, and doubtful as to continued and unfailing service.

The result of a series of tests of dry cells, which are readily divisible into loads suitable for climbing difficult ascents, however, warranted the design and construction of two new lamps, the use of which, undoubtedly, will increase the present number of observing nights per month by at least twenty-five per cent.

The main part, an ordinary automobile head light, is suitably mounted for directing in the horizontal and vertical; the lamp is provided with an ammeter, a small rheostat and a switch. The whole, packed in a strong case, weighs twenty-three and one-half pounds.

In order to obtain most nearly the maximum intensity of the light, it was necessary that the lamp bulb be provided with a filament concentrated to a degree not found in those on the market. One of the lamp manufacturers was induced to make the necessary designs and experimental tests, and submitted a number for trial.

At the present time all the lights of the stations surrounding the observer's station are kept burning



Battery Signal Lamp.

continuously from sunset to the closing of the observations for the night. The use of the dry cell was found practicable and not too costly on the assumption that the proposed lamp was to be kept burning throughout the night. The trial of the newly designed lamp by comparison with the present acetylene lamp, however, proved the former so much superior, that it was decided to have the lights shown only on signal, flashed with one of the new lamps by the observer, for the few minutes each time it is observed upon. This reduces very materially the consumption of current and battery cost.

The lamp, after being provided with two additional bulbs, one for medium and one for short distances, was tested by the Bureau of Standards, with the following results:

Apparent candlepower, at a distance of 100 ft. Lamp with specially concentrated filament, gas filled, 6 volts, 2.5 amp.	250,000
Automobile lamp, 6 volts, 1.8 amp.	50,000
Flash light lamp, 2.7 volts, .34 amp.	6,000

The candlepower of the acetylene lamp was used in the triangulation carried on by the Survey, measured under the same conditions, is 1500.

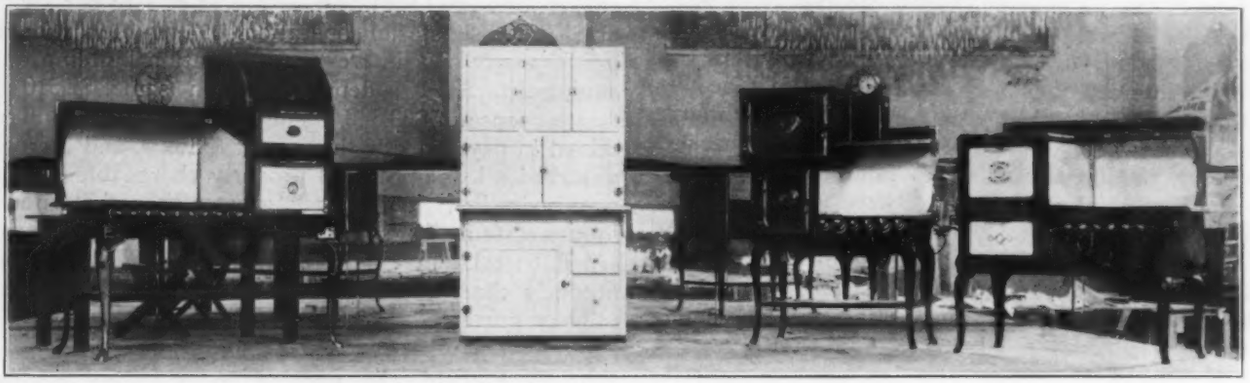
War tests of telephone and telegraph equipment, as successfully conducted by the U. S. Government May 6th and 7th, demonstrated the wonderful efficiency of the Pacific Telephone & Telegraph Company's system as well as the wonderful possibilities of the wireless telephone in maintaining communication with fleets at sea. In time of war the employes of a telephone or telegraph company, like those of a railway company, would be of greater service value at their regular occupations than on the firing line.

ELECTRIC COOKING SCHOOL AT SALT LAKE CITY.

BY B. W. MENDENHALL.

For the first time in Salt Lake City the electric range has been used exclusively in a special demonstration of cooking and cooking appliances. For several years past various manufacturers of food products and household appliances have conducted special cooking schools and demonstrations, and the gas company has always furnished the ranges used.

A cooking school held at the Auditorium, Salt Lake City, April 17 to 22, for the first time found the electric range as the star performer on the platform. The illustration shows the Hughes, Copeman and Acorn ranges which were used. The Utah Power & Light Company had a large booth in the exhibit section of the demonstration, at which practically all of the important makes and sizes were shown, and demonstrators in attendance at all times to explain the features of the ranges and to answer any questions not made clear by the demonstrator with reference to their characteristics of operation and cost. The special lecturer engaged for this school was Mrs. Florence Osborne Chase of Chicago. While Mrs. Chase had had considerable experience with electric cooking, some of the ranges were new to her. However, with her wide, general experience, the demonstration went off smoothly. She had not had time to familiarize herself with the rates in effect in this section of the country and with the current consumption for various operations on different ranges, and was unable to answer many questions covering this feature of electric cooking. However, an excellent start was made, and the problem for the power company in some other city to induce those in charge of these lectures to use electric ranges has been simplified. As more and more of these special lecturers in household economics become familiar with the operating characteristics and special features of electric appliances for the home, their introduction will be much more rapid.



Electric Ranges Used in Stage Demonstration.

In addition to the Utah Power & Light Company the Western Electric Company and the Capital Electric Company maintained booths in the exhibition section of the school. All of the companies report that they note a much greater familiarity with electrical appliances exhibited by the public at these demonstrations than was the case a few years ago, when many of the appliances which are now common in the home were then regarded as curiosities.

MUNICIPAL LIGHTING PLANT OF SEATTLE SHOWS LOSS FOR 1915.

The Washington State Bureau of Inspection and Supervision of Public Offices has completed a check of the municipal lighting department of the City of Seattle for the year 1915. The report shows gross revenue of $1,067,180.02; operating expense, including depreciation, $738,007.79; interest charges and other deductions amounting to $130,083.82; and a surplus of $199,088.41. For 1914 the report of the lighting department shows a surplus of $310,967.24.

In both reports failure to deduct certain items of expense has resulted in showing a greater surplus than really exists, and when lost taxes are taken into account, the plant operated at a loss in 1915. The following comparative statement shows the performance of the plant for the years 1914 and 1915. The figures are taken from the official report, with additions thereto to include a part of bond interest and redemption funds paid out and set aside from earnings during the years noted, but which were not deducted in the reports in arriving at the net surplus:

Expenses.

	1914.	1915.
Generating:		
Operation	$105,117.71	$178,630.24
Maintenance	42,366.53	33,027.35
Distribution:		
Operation	135,387.31	156,839.84
Maintenance	18,376.98	37,325.76
General expense	173,208.95	163,556.88
Total	$474,457.48	$559,380.07
Interest on bonds	$ 84,078.20	*$168,128.12
Total	$558,535.68	$727,508.19
Interest on warrants		**2,614.25
Total	$558,535.68	$730,122.44
Bad accounts	5,633.10	8,783.87
Total	$564,168.78	$738,906.31
Depreciation	173,257.13	178,627.72
Total	$737,425.91	$917,534.03
Profit and loss adjustment		8,785.96
Total expense	$737,425.91	$926,319.99

* The bond interest is given as $100,618.49, while the accumulated bond interest for 1915 was $168,128.00.

** Warrants drawing 5 per cent were issued for current expenses, there being no cash on hand.

Revenue.

	1914.	1915.
Private consumers:		
Business lighting	$238,162.00	$254,104.94
Residence	409,441.77	423,417.01
Power	106,640.39	114,472.15
Domestic power	3,933.30	6,997.60
Miscellaneous	471.03	258.50
Street lighting paid by private consumers	4,190.77	3,949.35
Total	$762,839.26	$803,199.55

Municipal service:		
Business	$ 25,483.77	$ 26,285.85
Residence	38.75	17.25
Power	25,295.85	22,241.30
Street railway	8,780.30	11,808.62
Street lighting	221,404.47	199,994.95
Street lighting, commercial	1,636.10	.....
Total	$282,639.24	$260,347.97
Miscellaneous revenue:		
Motor rents (private)	2,766.85	3,440.20
Motor rents (municipal)	46.80	9.80
Cutout and other charges	101.00	182.50
Total	$ 2,914.65	$ 3,632.50
Total revenue	$1,048,393.15	$1,067,180.02
Total expense	737,425.91	926,319.99
Balance	$310,967.24	$140,860.03
Bonds redeemed	*50,000.00	71,000.00
Balance for reserve and contingencies	$260,967.24	$ 69,860.03

* Taken out of earnings to redeem bonds.

It will be noted in the above statement of expenses for 1915 that the bond interest is placed at $168,128.12, in lieu of the amount shown in the report of $100,-618.49. The first amount represents the accrued interest on bonds outstanding for the year 1915, and includes interest on bonds of $1,400,000 for the new Cedar River dam, which was completed November 1, 1914. The water was turned into the basin back of the dam, the banks failing to hold it, since which time unsuccessful attempts have been made to seal it. No solution of the problem has yet been found, and no engineer has been found who is prepared to say that the basin can be successfully sealed at a cost not prohibitive. The investment in this dam, including structures, to January 1, 1916, according to the report, was $1,699,223.

While there is an apparent surplus for the year 1915 of $69,860, this surplus disappears and a deficit of $6850 is shown when lost taxes, amouting to $76,-710, are considered. This loss to the taxpayers is increased by an additional $100,034, which the lower rate offered by the private company a few years ago for street lighting would have saved, making a total economic loss to the taxpayers in 1915 of $106,884.

The gross revenue in 1915 increased over 1914 only $18,786.87, while the expenses increased $188,-894.08.

The state report gives the cost of current at 2.959c per kilowatt hour for street lighting. The theory on which this cost is worked out is wrong, and a careful analysis and searching investigation of the figures in this report, based on 5,324,000 kw.h. consumed for street lighting, shows a cost of $133,380.00, or 2.50c, per kw.h. The rate charged the general fund or taxpayers was 4c per kw.h., producing a profit of 1.5c per kw.h. from street lighting current. Commercial lighting and power consumers used 28,453,000 kw.h., at a cost of $788,723, or 2.77c per kw.h. The rate of return from this service was 3.02c per kw.h., showing a profit of .025c per kw.h. In other words, street lighting showed a profit of 1.5c per kw.h. while commercial and other light and power produced only ¼c per kw.h profit. Putting it in another way, street lighting, with a gross of $203,944, produced a net revenue of $70,566, while commercial and other service, with a gross of $859,345, showed a net revenue of only $70,620. In figuring the cost of current and arriving at the year's profit from operation, sinking fund requirements and lost taxes have not been considered, which, if taken into account, show that service has been furnished at less than cost. The charge for street lighting has been increased from 4c to 4½c per kw.h. for 1916 to compensate for the unprofitable rate charged private consumers for service.

The average cost of all current generated and delivered from the city plant is very high. A total of 33,775 kw.h. were furnished for consumption, at a generating cost of $372,300, or 1.1c per kw.h. This is undoubtedly a much higher cost than can be found in any plant of similar size on the Pacific Coast.

Current for power is furnished to the municipal railway, which has been showing large deficits from the beginning of operation. In order to make the best possible showing for the railway, the lighting department has been made to absorb part of the loss in the power rate allowed to it. The main substation of the lighting department delivered to the railway substations 1,574,500 kw.h. at a cost of 1.1c per kw.h., or $17,320; substation operation and maintenance expense was $9797; interest on substation building and equipment, $3,716; depreciation on same, $2,510; a total expense of $33,342. The lighting department received in payment for this power $11,809, and thereby absorbed a loss of $21,534 properly chargeable to railway operation. This loss is greater than that shown by the state auditors, owing to the fact that they have failed to take into account many items of expense properly chargeable to the expense of producing the railway power.

There has been invested in the city plant up to January 1, 1916, the sum of $6,786,257.80, against which stand bonds amounting to $3,923,000, drawing an average interest rate of 4½ per cent. A cash depreciation reserve fund of $49,178.36 is on deposit in banks, drawing 2 per cent interest, while warrants issued for current expenses amount to $124,084.95, drawing 5 per cent, are outstanding.

SOME FAULTS OF THE SMALL ELECTRIC ARC FURNACE FOR MELTING AND REFINING STEEL.

B W. M. McKNIGHT.

(Suggestions are here given for improving the electric arc furnace. This paper was presented at the Washington meeting of the American Electrochemical Society, April 27, 29, 1916. The author is with the Southern California Edison Company, Redondo Beach, Cal.—The Editor.)

The small electric arc furnace is rapidly coming into favor for the production of small, highly refined steel castings, and its advent is welcomed by both the manufacturers of steel castings and the electric power companies. Without going into the merits of the electric furnace as a competitor of the crucible furnace and open-hearth furnace, regarding the quality of the product or regarding it as a welcome load builder for power companies, I wish to point out some of the handicaps to its universal adoption and successful operation.

The furnaces that are now in operation in several parts of this country, while differing in some respects in their mechanical costruction and electrical demands, all refine the steel by the same chemical process, viz,. by raising the temperature of the bath to 2500 deg. C. or better, by boiling the metal to eliminate the im-

purities, and by the introduction of the necessary refining agents to bring it up to the fineness desired.

All small arc furnaces are constructed on certain general mechanical lines, as follows: The furnace consists of a steel shell mounted on trunnions for tilting to dicharge the molten metal. This jacket is lined with a highly refractory lining, sufficiently thick to retain the heat; the lining and shell, however, are pierced with port-holes for the purpose of charging the furnace with steel, adding the refining agents, discharging the refined metal and for inserting the electrodes, and all these port-holes furnish avenues of escape for the heated gases. The eletcrodes are secured in place by the holders mounted on the tilting shell, and the holder raises or lowers the electrode by hand operation, by hydraulic control, or by electric motor control.

Efficiency.

In spite of the fact that the electric furnace today is turning out small castings of a better quality and at a lower cost than by other processes, nevertheless, the over-all efficiency of the best furnaces on the market is far from 100 per cent.

There are three principal sources of loss:

Electrical—In the improper delivery of the energy to the metal.

Mechanical—In the improper design of the furnace shell and ports, to exclude cold air and retain the heat.

Chemical—The improper combinations of refractory materials, that should be inexpensive in first cost, withstand the intense heat long enough to avoid delays through the interruption of the manufacturing process, and not introduce any chemical combination with the metal. Also, there should be found an electrode that will not waste away too rapidly through oxidation, within and without the furnace, as it comes in contact with the air and gases.

Electrical conditions can be improved by supplying the proper current at the proper potential. Mechanical conditions can be improved by re-designing detail portions of the furnace. The chemical conditions can be improved only by exhaustive research and careful study.

Refractories.

Refractories are of two kinds: the heat-resisting linings and the heat-producing electrodes. The heat-resisting linings may be either acid or basic, depending on the degree of heat required for the quality of steel to be turned out. The heat-producing refractories may be either carbon on graphite.

Temperatures and Linings.

Merely to melt down steel scrap and turn out castings of semi-steel and low-grade castings of unknown quality does not require a temperature of 2500 deg. C., and for a furnace of this class of work an acid lining of silica is successfully used. To refine the steel, however, it is necessary to use a basic lining of magnesite, at least where it comes in contact with the bath, or where the heat would be intense enough to melt down the silica and cause it to run down into the bath and combine with the metal bath or slag and the basic lining, thereby changing their character.

The furnace linings can be put in in two ways: build up with brick work, the bricks made to conform to the shape of the shell and laid up in a basic paste or coal tar binder, or the material for the lining may be made up into a mass and rammed into the shell. The brick lining offers some advantages, inasmuch as it has passed through a glazing process that should prolong its heat-resisting qualities, but it is expensive, particularly if special sizes and shapes are desired, and if the source of supply is remote, and the delivery uncertain.

The rammed lining should be superior from the fact that it is, if properly put in, a monolithic mass, hence there should be little danger of the bath breaking through the shell, with the resulting damage to the furnace and loss of the batch.

Electrodes.

Electrodes are of two kinds: carbon and graphite. Each has its merits. The carbon electrode is the less costly, but has less electrical carrying capacity than graphite, and consequently must be greater in cross-section to deliver the same amount of energy. It therefore has a larger amount of radiating surface, and consequently the saving in first cost of the carbon is offset by the loss in energy dissipated in heat. Owing to the intense heat of the electrode, its surface both within and without the furnace shell loses carbon by its surface contact with the air and resulting oxidation.

The graphite electrode, by virtue of its greater carrying capacity, is smaller in diameter, and offers less surface for radiation of heat and oxidation. The electrode within the furnace shell is subject to further attack by the passage of the electric current through the heated gases to the lining, which, at a temperature of 2500 deg. C., itself becomes a very good conductor of electricity.

Conclusions.

Electric steel castings may not be better in quality than those turned out by skilled operators with fuel furnaces, but small electric steel castings can be made at a less cost under present conditions, which conditions could be improved, and then the furnaces will be limited only to the capacity of the source of the supply of electrical energy.

The field has apparently no limitations, if the chemist can overcome the losses I have pointed out. Formulate a better refractory lining, an electrode that will not waste away except in heating the bath, and utilize the waste gases by manufacturing them into a by-product or by-products.

I have only touched on one single product which gives promise of so much for the electric furnace. The field is undeveloped and has almost unlimited possibilities. In three Pacific Coast States alone, I am informed, there is approximately 1,000,000 horsepower in waterpower going to waste, because a too zealous government is retarding its development, by capital ready and willing to invest, if more liberal terms of lease can be secured. Such terms might be forthcoming if the American Electrochemical Society would bend its energies to make efficient power consuming devices.

This certainly is the day for the chemist, and his greatest achievements will be in the electrochemical field.

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The Washington Water Power Conference

The water power conferences at Washington, D. C., last month succeeded in convincing people that the national industrial efficiency and preparedness of America are dependent upon the early development of the water power, but failed to bring out the fact that the greatest scene for this development is in the West. Talk of a power famine is absurd when the tremendous latent water powers of the West are considered. With attention focused on the probability of governmental encouragement of air-nitrate manufacture, the fact should not be overlooked that a number of sites in the West and the South offer every inducement in the way of cheap power and strategic location. The Washington conferees seem to have overlooked their hand in this respect.

The Other Side of Public Relations

So much has been published in these columns about the development of better public relations on the part of the public utility that there seems to be danger of overlooking the fact that the public should also be careful in cultivating better relations with the utility. It takes two to make a friendship, just as truly as it takes two to make a quarrel. And so the action of some Western cities, in particular, is creating the impression that the citizens believe "if you have any money you need not come around."

Seldom has the truism that the present success of a city's public utilities is a direct prophesy of the future success of that city been more strikingly exemplified than in the case of Cleveland, Ohio. At the last census Cleveland was the sixth city in the United States in point of population and gave promise of being the fourth city at the next census. Meanwhile Cleveland became not merely the laboratory but actually the workshop for all sorts of socialistic theories, such as three-cent car fares, a municipal electric plant, and a dog-in-the-manger harbor policy. Although a bonded indebtedness of over fifty million dollars was incurred, the sewer system is inadequate, the fire and police forces are undermanned, and only six per cent has been set aside toward a sinking fund. As a result of this political mismanagement, which is inevitably the ultimate concomitant of municipal operation, private capital has been deterred from investment in this community and present forcasts of the next census show that Cleveland bids fair to be surpassed by Detroit, a city which has encouraged private enterprise.

This is a lesson which can be profitably applied in Western cities where municipal operation of technical utilities is gradually being introduced in competition with existing companies. This form of competition is so unfair, so unequal, that in the end it leads either to a great public loss or to practical confiscation of the private plant. The single feature of state regulation of a private utility and the independence of the municipal utility is manifestly unfair. One of the principal points investigated by a concern which proposes to build a

plant in a town is how the town treats the enterprise it already has.

One of the greatest mistakes in modern municipal government, as regards the general welfare of the community, is the failure to deal fairly with public utility companies. Prosperous utilities make for prosperous cities. Any attempt to confiscate the capital belonging to men who have saved it, can only temporarily benefit those who have not saved it. If capital is to continue to help cities, its wages must be paid as regularly and as completely as are the wages of any other class making for the general good.

A Foredoomed Experiment

More dismay has been occasioned by the San Joaquin and Mt. Whitney rate decisions of the California Railroad Commission than by any ruling hitherto made by that body. This chagrin is felt not so much by the companies directly affected as by other electric corporations who face a most serious situation if the principles here enunciated should be subsequently applied to their own affairs. The two companies immediately affected are bravely attempting the impossible and manfully trying to work out a solution.

Both the San Joaquin Light & Power Corporation and the Mt. Whitney had been serving irrigation consumers at a flat rate of $50 per horsepower per year. In each case the commission has not only reduced this rate to $42.30, but has given an alternative monthly graded rate whereby a farmer may have seven months' service for $29.75. As seven months is the average period for irrigation pumping in the San Joaquin Valley, the new rate represents a reduction of virtually forty per cent in the income per horsepower of installed capacity from such irrigation consumers.

This reduction in rates, and corresponding decrease in income, comes at a time when prices for material are rapidly increasing. The costs of new construction to care for new business that might be attracted by the lower rates are almost prohibitive.

Coupled with this tremendous reduction in rate, the consumer may secure service without signing a contract or without giving any guarantee that bills will be paid, such as was formerly secured by a lien on the land. Although this ruling merely follows that laid down by the commission in other cases, it is none the less the source of considerable loss to all companies, as it removes the protection ordinarily granted to any other line of business against the "dead beat."

Heretofore, the consumer was required to grant a right-of-way across his land to obviate the cumbersome and expensive practice of following the roads laid along section lines if the next-door neighbor also desires to be served. This provision is now eliminated and the matter "left to unfettered bargaining between the customer and the utility." Any one having any experience in this regard knows that such "unfettered bargaining" is only a mild way of saying "hold up."

It is to be noted in the foregoing statement of facts that no reference has been made to disputed points in valuation, wherein allowance has been made neither for going concern value, water rights, nor franchises, no attention has been given to the great amount of development work necessary to create an agricultural pumping load, nor no argument advanced that the scheme of rate making is extremely theoretical and highly experimental. The conclusions from the facts cited are so obvious as to need no further comment here.

Notwithstanding the tremendous difficulties involved in continuing to furnish electric power at these rates, the men in charge of these companies are undoubtedly equal to the emergency. Just as the railroads, regulated to the quick by the Inter-State Commerce Commission, were almost able to cut expenses to meet the rate reductions, so the power companies will try to cut costs. But as a result service cannot but be impaired and repairs reduced to an absolute minimum. The roadbed and equipment of the railroads of the country finally were in such poor condition and their financial situation so weak that the Interstate Commerce Commission was compelled to increase the rates.

With such an example so recent and so vivid, it seems poor policy to try the same tactics with the power companies. Like many laboratory experiments it failed in practice. And ultimately the public are the sufferers.

While the law may compel men to accept rates imposed by commissions there has been no law that compels a man to continue a losing business. Here again the railroads furnish a pertinent instance: Running from the prosperous city of San Diego, California, is a little road that has been steadily losing money because of the low rate for parcel post business and because of unregulated automobile competition. Suddenly there came a flood that wiped out most of the roadbed. As losses furnish no incentive to investment, the owners wisely concluded that it was futile to throw good money after bad and abandoned the road. The people at last saw a great light. They vainly tried to raise the necessary funds by stock subscription and now have applied to this self-same railroad commission to compel the owners to rebuild. The commission has not yet decided what should be done but reason would suggest that unless the parcel post rates are raised and automobile competition regulated the owners should not be compelled to re-invest in a losing proposition. Another branch road, running to Yreka, California, confronts the same trouble, without the providential relief of a flood in sight. The delay due to freight loaded on as mail makes it possible for jitneys to give better passenger service.

The experience of the railroads is indicative of the condition confronting the electric companies. In the light of these other experiments in railway rate tinkering which have so signally failed, why repeat them with the electric power companies?

PERSONALS

W. D. Steele, vice-president of the Benjamin Electric Company, is at Seattle.

Earl G. Wilson, electrical dealer from Napa, was at San Francisco this week.

S. B. Gregory, Pacific Coast manager for the Arrow Electric Company, is at Los Angeles.

D. E. Bailey of the Bailey-Drake Company has returned to San Francisco from Los Angeles.

Clarence Rylander of the Western Electric Company has returned to Seattle from San Francisco.

H. E. Sanderson, representing the Bryant Electric Company, is in the Northwest on a business trip.

Chas. Northcutt of the Modesto Electric Light & Gas Company of Modesto, California, is at San Francisco.

A. F. Flannagan, manager Electrical Engineer & Supply Company, Stockton, was at San Francisco this week.

H. G. Levy of the Electric Manufacturing Company is making a business trip to Los Angeles by automobile.

Henry F. Yost of the Trumbull Manufacturing Company is at Sacramento on his first trip for the above company.

Gerard Swope, vice-president and general sales manager of the Western Electric Company is at the Yosemite Valley.

C. J. Winslow, salesman Electric Appliance Company, has returned to the San Joaquin Valley from San Francisco.

L. E. Sperry, agent for W. N. Matthews & Co., Bros., Inc., has returned to San Francisco from a trip in Northern California.

J. F. Macpherson, general auditor of the Federal Sign System, with headquarters in Chicago, will be at San Francisco next week.

W. I. Otis, representing the Detroit Fuse & Manufacturing Company and other companies, left San Francisco last week for Southern California.

H. D. Aylsworth of the Aylsworth Agencies Company of San Francisco, left for the East via Los Angeles last week and expects to be gone at least a month.

C. H. Hunt, Pacific Coast manager of the Robbins & Myers Company, has returned to San Francisco from a short business trip to Los Angeles.

K. Muzutani, former secretary of the Japanese Commission at the P. P. I. E., will represent the Bailey-Drake Company in Japan. With him will be Wm. Finnigan.

L. B. Van Atta, of the sales department of the Pacific States Electric Company, is back at his desk again after a campaign of appliances in the territory between Oakland and Chico.

Chas. N. Black has resigned as vice-president and general manager of the United Railroads of San Francisco to devote his time to the work of Ford, Bacon & Davis, of which firm he is a member.

B. A. Wagner, manager of the Electric Agencies Company, and **N. Abrams,** manager of the Western Agencies Company, have returned to San Francisco from a week's fishing trip in Mendocino county.

Paul Butte of the Butte Engineering Company has returned to San Francisco from Walnut Grove, where they have been installing the electric system on the county bridge over the Sacramento River.

W. D. Thomas, salesman for the Electric Railway & Manufacturers' Supply Company, has returned from a trip to the San Joaquin Valley, while **Raymond Kahn** of the same company is back from the Sacramento Valley.

J. Peterson, electrical engineer of Christiana, is at San Francisco, en route to China and Japan. He has been visiting most of the large electrical plants throughout the East and will make scientific investigations in the Orient.

Albert Meinema, city sales manager of the Electric Appliance Company at San Francisco, said that the demonstration of electric ranges at the Oakland Motor Show has produced such good results that they are entirely out of ranges.

C. W. Cowles, former electrical dealer and contractor of Red Bluff, California, has sold out his contracting and supply business in Red Bluff and entered the employ of the U. S. Navy Department as electrical expert aid, being stationed at Bremerton, Wash.

Wm. Jacobs, representative of the Santa Cruz Chamber of Commerce, who is at San Francisco, announced that arrangements had been made for the installation at Santa Cruz of a battery of scintillators such as were utilized at the P. P. I. E., which will make surf bathing possible at night.

E. Murray, salesman for the Western Electric Company, is back from a trip to Southern California. **W. Todt** of the same company leaves this week for the northwestern part of the state. **W. B. Lewis** leaves for Nevada and Northern California, while **Frank Du Frane** is in the southern part of the state.

Morril N. Farr, formerly in the electric service department of the Utah Power & Light Company and **P. J. Diebold,** formerly in the manufacturing department of the Capitol Electric Company, have resigned their positions and have incorporated the Farr-Diebold Electric Company with offices at 24 Richards street, Salt Lake City.

R. S. McClelland, chief engineer Electric Bond & Share Company of New York, was at San Francisco the past week discussing with local engineers the proposed Electrical Safety Code of the U. S. Bureau of Standards, as well as the subject of inductive interference and the selection of insulators to minimize failure. He is returning East via Salt Lake Sity. At Chicago, May 29th and 30th, following the National Electric Light Association convention, there will be a meeting of engineers to discuss these several matters.

OBITUARY.

Enos M. Barton, one of the founders of the Western Electric Company and for twenty years its president, died at his southern home in Biloxi, Miss., May 3, 1916, at the age of seventy-two years. Since his retirement from the presidency of the company in 1908, he had been chairman of its board of directors.

MEETING NOTICES.

Electrical Development and Jovian League.

The May 3d meeting was characterized by a spirit of even more than ordinary good comradeship, brought about, it is thought, by new quarters in the Palace Hotel. Sam Hamilton, as chairman "emergentas," provided good entertainment and a fine speaker in Dr. Philip Jones, secretary of the State Medical Association, who told of pending legislation on industrial health insurance.

Illuminating Engineering Society.

The tenth annual convention of the Illuminating Engineering Society will be held in Philadelphia, September 18, 19 and 20. Immediately following the convention there will be given at the University of Pennsylvania under the joint auspices of the University and Society a course of twenty lectures on the theoretical and practical aspects of illuminating engineering. The lectures will be given by eminent authorities in the lighting world and will take approximately eight days.

Oregon Electrical Contractors' Association.

The Oregon Association of Electrical Contractors and Dealers now have a membership of 59 regular and three associate members. During "house wiring month," from March 15 to April 15, 1916, 185 already built houses were wired, the E. L. Knight & Company being the prize winners with 38 wired. So well pleased are all taking part that it is proposed to put on another and greater campaign in the

fall. Mr. Carpenter of the Meier & Frank and J. C. English were the principal speakers at the educational meeting held on April 12th, the subjects were merchandising and figuring profit.

San Francisco Section American Society of Mechanical Engineers.

At a meeting on April 20th at the Engineers' Club, D. E. Keppelmann of the Pacific Gas & Electric Company gave an interesting account of oxy-acetylene welding as employed by his company for joining high pressure gas mains. This company has a 16 in. main through the heart of San Francisco from the Potrero to North Beach and an 8 in. transmission main encircling the city. Asbestos or rubber gaskets were used in the former at a cost of about $4 per joint, with a subsequent high cost of maintenance because of joint leakage. The same couplings on a 16 in. pipe with the oxy-acetylene process costs $2.50, with no further expense. Consequently this process has been adopted in the latter case. Mr. Keppelmann's talk was illustrated with lantern slides which showed full details of the process.

Los Angeles Jovian League.

Chauncey T. Carr, heating device specialist with the General Electric Company, was chairman of the day at the luncheon on May 3d, and furnished an excellent speaker, a big entertainment, and also introduced a number of laughable and entertaining innovations which created much merriment, and were heartily enjoyed. The speaker of the day was Dr. Arthur S. King, superintendent of the physical laboratory of the Mount Wilson Observatory. His subject was "The Equipment and Method of Work at the Mount Wilson Solar Observatory." He described the new 100 in. telescope now under construction, which will be used for studying the solar spectrum and for observing celestial phenomena. This telescope, the largest instrument in the world, has moving parts which weigh one hundred tons; the lens alone weighing five tons. He described the many ingenious electrical devices used in connection with the various instruments, and stated that fifty and twenty-five horsepower units with remote control were used in connection with the telescopes, the power being generated on the mountain. The Mount Wilson Solar Observatory, which is endowed by the Carnegie Institute of Washington, is the most modern of all astronomical institutions in point of method and equipment. An invitation to visit the observatory was extended to the members of the league. A novelty musical number by Zoe Wallace, singing comedienne, concluded the program.

A. I. E. E. National Meeting.

On May 16th a national meeting of the American Institute of Electrical Engineers, to commemorate the achievements of its members in the fields of communication, transportation, lighting and power, will be held jointly in San Francisco, Chicago, Atlanta, Philadelphia, New York and Boston by long distance telephone service. All of the auditoriums in which the meetings are held will be connected by telephone circuits, and every seat in each hall will be provided with a telephone receiver so that everyone in attendance will be able to hear the proceedings in each of the participating gatherings in other cities in turn.

The President of the A. I. E. E. will preside at New York and there will be a local presiding officer and principal speaker at each of the other cities. The meeting will be opened by President Carty who will address all the above cities simultaneously by telephone, following which will be greetings by prominent members of the Institute in different parts of the country, and other proceedings of interest conducted by telephone. The second part of the program will consist of an address by the principal speaker in each city to the local audience only, and will occupy about 30 minutes.

At the close of the simultaneous addresses, telephone greetings will be transmitted from each city to all of the other gatherings, and musical selections will be rendered by telephone between the different cities. Local orchestras will provide music at the various meetings which will not be transmitted by telephone.

REGULATION OF TELEPHONE COMPANIES IN UTAH.

The first step toward the regulation of public utility corportations in the state of Utah has been taken by the Board of County Commissioners of Salt Lake county within, which county Salt Lake City is located. The commission has enacted an ordinance providing that all charges for telephone service shall be just and reasonable and every unjust or unreasonable charge made shall be prohibited and declared unlawful. Service, equipment and facilities shall be furnished by every telephone company to promote the safety, health, comfort and convenience of its patrons, employes and the public. Every telephone company operating within the county must file with the board of county commissioners within sixty days of its passage a schedule of all rates together with all rules and regulations pertaining to rates. The rules and regulations made by any telephone company must be just and fair.

Schedules of rates filed by any telephone company shall not be in excess of the rates in effect by it on March 1, 1916. No change shall be made in any schedule of rates or service classification, nor shall any rule or regulation be changed unless so ordered by the board of county commissioners. Every telephone company in the territory affected by the ordinance must receive and transmit messages from other telephone companies with the lines of which connections may have been made or have been ordered by the board of county commissioners.

Upon finding that any rate is unjust or unfair the board of county commissioners may determine a just and fair rate for service and the telephone company concerned shall observe such action of the board and operate in conformity therewith. The passage of this ordinance is the outcome of a controversy between the Mountain States Telephone & Telegraph Company and its patrons over the matter of toll charges between exchanges in Salt Lake county.

NEWS OF CALIFORNIA RAILROAD COMMISSION.

The Fontana Power Company of San Bernardino county has filed with the commission an application for authority to go into business as a public electric utility, to build a power plant and transmission system, to sell $350,000 worth of bonds, and to mortgage its property to secure this issue. The company also proposes to lease its properties to the Southern California Edison Company for thirty years.

The Imperial Telephone Company and the Pacific Telephone & Telegraph Company have filed with the railroad commission a joint application for authority for the Imperial Company to sell to the latter its entire system for $165,643.67.

The Mt. Whitney Power & Electric Company has filed with the commission an application for authority to issue 450 bonds of $1000 each, at 6 per cent interest, payable semi-annually to reimburse it for expenditures made primarily in the purchase of consumers' transformers.

The San Francisco-Oakland Terminal Railways has filed with the commission an application for authority to issue promissory notes for $180,000, in denominations of $1000 and $500 each at 6 per cent, callable at 100½ and interest on 60 days' notice, and maturing between 1917 and 1925.

NEWS OF OREGON PUBLIC SERVICE COMMISSION.

With the merging of the Coos & Curry Telephone Company and the Coquille Valley Telephone Company, under the former name, the consolidated system has filed application with the commission for authority to make increases in rates for service for all the territory covered by its lines. The commission will investigate the conditions existing before passing upon the application. The company operates in Marshfield, Coquile and Myrtle Point.

PACIFIC GAS & ELECTRIC COMPANY'S NEW POLICY REGARDING SALE OF ELECTRIC APPLIANCES AND RANGES.

With the termination of the electric appliance sales campaign that has been co-operatively conducted by the Pacific Gas & Electric Company and the electrical supply jobbers, comes announcement of new plans. The sale of socket appliance will be actively taken up by the local dealers and the company will pay the dealers a premium of fifty cents for each appliance sold and will assume installment contracts when the credit of the purchaser is approved by the district manager.

As regards the sale of electric ranges and water heaters tentative arrangements are being made. In districts where dealers satisfactorily demonstrate their selling ability the company will not enter into active competition and will bear the cost of conecting ranges old sold to consumers on existing lines. It will further aid dealers by co-operating with them from time to time in conducting cooking demonstrations, the company furnishing a competent demonstrator, supplies and space for demonstration to be furnished by the dealer. Dealers will be expected to maintain an attractive display of ranges and water heaters and to advertise electric cooking by distributing literature and by newspaper advertising.

In territory where dealers do not take up actively the sale of ranges the company will do so. This company's sale prices are based on an advance of 25 per cent on the price f.o.b. San Francisco, subject to a discount of 10 per cent for cash. Installment terms, 10 per cent down, balance in ten equal monthly payments.

Where dealers sell ranges in accordance with the prices established by the company it will arrange to relieve the dealer of installment contracts, where the purchaser's credit is satisfactory, by paying the dealer the cash price established by the company and collecting from the purchaser the installment price, retaining the difference of 10 per cent as compensation for the accommodation.

TRADE NOTES.

The H. B. Squires Company has opened a branch office in Seattle at No. 309 First avenue, South, with Mr. T. N. Bristow, late of the Westinghouse Company, in charge.

The Electric Agencies Company is building a new salesroom just above the present location at No. 247 Minna street, San Francisco, to accommodate more business. The Western Agencies Company will occupy one-third of the space in the new building.

The Central Electric Company of San Francisco had the lowest figure in the electric wiring and equipment for Engine House No. 8, their bid being $994. The Turner Company was the next with $1178. Roberts Manufacturing Company took the fixture contract on the job for $897.

The American Electrical Engineering Company was the successful bidder on the electrical wiring equipment for the two Myers buildings just erected at Bush and Van Ness avenue, San Francisco. This is one of the largest wiring contracts completed for some time, amounting to $915.

The Bailey, Drake Company, San Francisco, has taken over the Luminous Specialties Company's line, whose home office is at Indianapolis, Ind. This company has also gone into the export business in earnest. They now have resident salesmen in Japan, China, the Philippines, Australia and New South Wales.

Ralph Clapp has sold his interest in the Drake-Clapp Electric Company of Los Angeles to A. G. Drake and has established offices in the San Fernando Building, Los Angeles, as representative of the American Circular Loom Company, Stanley & Patterson, Electrical Engineers Equipment Company, Wisconsin Electric Company, etc.

The Western Agencies Company recently organized in San Francisco with offices and stockrooms at 249 Minna street, is representing a number of well known manufacturers of lamps, flashlights, auto specialties and other similar materials. The president and manager of the company is Nicholas Abrams, formerly connected with the Interstate Electric Novelty Company, and who is widely known among the trade throughout the entire western territory.

The Standard Underground Cable Company announces the following changes in the locations of several of its branch offices: The Chicago office is now located in the Conway Building, having on May 1st moved from The Rookery where it was located for many years. The Detroit office has moved from the Free Press Building to the Whitney Building. A new office will shortly be opened in Minneapolis, Minn., in charge of W. J. Weld. In the Pacific Coast Department the Portland, Ore., office has been discontinued and a new office opened in the Newhouse Building, Salt Lake City, Utah, in charge of F. W. Wilson.

ELECTRICAL BASEBALL LEAGUE.

On Friday night, May 5th, the Electrical Baseball League of San Francisco held their benefit dance at Maple Hall, and from the large crowd in attendance and the good time enjoyed by all, it can easily be said that it was a great success, socially as well as financially. There were over 250 in attendance.

Ermsco vs. Western Electric.

The fast Western boys now have another feather in their cap after trimming the Ermsco boys in a 12 to 4 contest. The game was rather late in getting started, but both teams played fast and furious, and the result was one of the fastest games that has ever been played in the League. Only eight innings were played, but these were finished in one hour and twenty-five minutes. The pitchers of both teams did very good work. Steffens of the Western struck out 12 of the 42 men that faced him and only walked 2, while Finley of the Ermsco struck out 12 of the 40 men that faced him and only walked 2. Western started the game off to their advantage, the first man up getting a hit, and coming in for the first run. The first three men up for Ermsco failed to reach the sack. The second inning neither side scored, but in the third both teams succeeded in landing a man over the home plate, which made the score 2 to 1 in Westerns favor. In the fourth there two hits made by each team, but neither was able to make them count. In the first of the fifth Ermsco got another run which tied the score, but the Western boys seemed to get the drop on the ball in their half of the fifth and galloped five men around the bags. They got four more in the sixth and one in the seventh, and then Ermsco came to life and made two runs in the eighth, which ended the game with a 12 to 4 score.

Pacific States Electric and General Electric Game.

The game was started promptly at 2 p. m. at Ocean Shore grounds and was a game fullof "pep," but teams having an object in view, the States to uphold their title as "League Leaders" and the G. E. boys in their attempt to crawl out of the cellar. "Co-operation," in another form, namely—good team work—and good support from a large rooting section, were two of the chief reasons for the Pacific States Electric Company's team upholding their title as "League Leaders," when they defeated the General Electric Company's team to the tune of 11 to 4.

The "States" boys showed their best form in their good fielding and also brought up their batting average when they found both of the G. E. twirlers. A sensational home-run was booted out by Fred Kaiser whose long legs easily carried him around the bags and then some.

The G. E. boys tried hard to dig their way out of the cellar and showed some very fast in-field work.

NEWS NOTES

ILLUMINATION.

LOS ANGELES, CAL.—The city council has voted to light Adams street between Grand avenue and Figueroa with the same kind of lights as will be used on West Adams street.

HUNTINGTON BEACH, CAL.—The city trustees are negotiating for the installation of 300 additional ornamental lamp posts to be installed throughout the residence district.

BRAWLEY, CAL.—Estimates on new lighting systems have been presented to the city commission. There are two plans. One calls for an expenditure of $2074 and the other $1124.

LOS ANGELES, CAL.—The city council has ordered the necessary ornamental lighting posts and appliances installed and maintained for a period of one year for lighting Hollywood Boulevard.

COTTONWOOD, IDAHO.—B. L. Sivyer states that the Grangeville Electric Light & Power Company intends constructing a big electric light and power plant on the Clearwater during the summer.

POMONA, CAL.—A resolution of intention has been passed by the council ordering cast reinforced concrete posts, wires, conduits, lamps and appliances for street lighting installed on portions of Alvarado street, Columbia avenue, and Jefferson avenue.

REDONDO, CAL.—The city engineer has been instructed by the council to start proceedings for the installation of ornamental lamp posts along Catalina avenue from Opal to Pacific, on Pacific from Diamond street to Opal, on Diamond from Pacific to Camino Real, on Camino Real from Diamond to the city limits.

FULLERTON, CAL.—Interest in an ornamental lighting system was renewed here when it became known that the city council had received an offer from a Los Angeles concern to place electroliers on Spadra and Commonwealth avenues. The plan calls for the installation of 134 lights at a cost of $1.30 a front foot.

NOVATO, CAL.—The Pacific Utilities Company has petitioned the supervisors for a 25 year franchise to serve the township of Novato with electric light, power, water and telephones. The company is a $50,000 corporation, with R. H. Trumbull, A. D. Scott, Frank Silva and the Cain Bros. as directors and stockholders.

NEWPORT BEACH, CAL.—The city trustees have signed a contract with the Southern Counties Gas Company for distributing natural gas from the Standard Oil Company fields near Fullerton. The contract calls for a four-inch pipe line to be laid from Garden Grove to the city limits. Construction of the new line will begin at once and will be completed within sixty days.

LOS ANGELES, CAL.—Proceedings for installation of an ornamental lighting system in Hobart Boulevard have been held up by property owners who presented a petition to the council for the use of marbelite light standards instead of the cast iron type proposed. Proceedings have been continued two weeks to permit property owners to get together and agree upon the type of light post to be used.

BANNING, CAL.—The stockholders of the Banning Gas & Lighting Company have accepted the proposition of a Los Angeles company to purchase the plant. The Los Angeles people plan to take over the Beaumont plant also, and supply the two cities from one plant. Stock in the new plant would be taken by the people who have stock in the present gas companies. It is said that the deal is quite likely to be closed and the gas plants of the two cities will undergo extensive improvements.

TRANSMISSION.

SAN FRANCISCO, CAL.—The City Electric Company will erect a two story brick substation on North Bush street west of Grant avenue to cost $90,000.

SPOKANE, WASH.—Renewed mining activity is reported in the Princeton District of British Columbia. It is stated that the British Columbia Copper Company will install a power plant this spring.

VISALIA, CAL.—A new 33,000 volt transmission line is being erected between Visalia and Exeter by the Mt. Whitney Power & Electric Company. The line represents an expenditure of close to $30,000. Sixty foot poles are being used to carry the line above the other lateral feed lines.

RIVERSIDE, CAL.—Chas. H. Dehacour has applied to the board of supervisors for a franchise to erect and maintain for a period of fifty years a pole-tower and wire system for transmitting electricity along certain roads of Riverside county. Sealed bids will be received for the franchise up to May 17th.

TELEPHONE AND TELEGRAPH.

SALINAS, CAL.—The board of supervisors has granted permission to Charles and Henry Bardin to construct a telephone line along the county road to their Gabilan ranch.

SANTA BARBARA, CAL.—Engineers of the merged telephone company here are busy preparing plans and specifications for the work which must be completed before the two systems are consolidated on June 1.

LOS ANGELES, CAL.—The People's Telephone Committee has filed with the city clerk a petition urging the council to adopt or submit to the people an ordinance providing for an $8,000,000 bond issue for the establishment of a municipal telephone system in Los Angeles.

TRANSPORTATION.

SAN FRANCISCO, CAL.—The board of supervisors has directed the board of works to go ahead with the Church street car line and has also started proceedings for the laying of tracks on Market street from Church street to Twin Peaks tunnel and from Van Ness aveneu to Kearny.

SALT LAKE CITY, UTAH.—Announcement has been made by General Manager Joseph Nelson of the Salt Lake & Los Angeles Railway Company that final and definite arrangements have been perfected for the electrification of the company's line which operates between Salt Lake City and the Saltair Beach pleasure resort, fifteen miles west of the city; also that the company will extend its line from Saltair to Garfield, a distance of three miles. Ties, rails and the other equipments necessary for this extension have already been ordered and work will begin in the near future. Preliminary work on the electrification of the main line to Saltair has been begun. At the half way passing point over an additional mile of passing track has been put in. When the road initially electrified it will be operated as a single track line with long double track turnouts at passing points and these will gradually be extended until the entire line is double track. General Manager Nelson announces that arrangements have been completed with C. F. Childs & Company of Chicago to finance the Garfield extension and the electrification of the line. Engineers and financial representatives of that company have made exhaustive investigations of the property by whose recommendations the company were so favorably impressed with the property as to enter into the contract to finance it. H. A. Strauss, the consulting engineer with offices in the Harris Trust Building, Chicago, has been engaged to prepare plans and specifications for the electrification.

ALPHABETICAL INDEX TO ADVERTISERS

The letter and number before each name are used in the classified page following

A-1 American Ever-Ready Works of National Carbon Co.. Los Angeles; 755 Folsom St., San Francisco; Seattle.

A-2 Atchison, Topeka & Santa Fe Railway Co..... 673 Market St., San Francisco; 1218 Broadway, Oakland.

B-1 Baker-Joslyn Company..... 2
71 New Montgomery St., San Francisco; 911 Western Ave., Seattle; 353 E. Second St., Los Angeles.

B-2 Benjamin Electric Manufacturing Co..... 590 Howard St., San Francisco.

B-5 Bridgeport Brass Co..... 4
(See Pierson, Roeding & Co.)

C-1 Century Electric Co..... 3
906 So. Hope St., Los Angeles; 56 Natoma St., San Francisco; 65 Front St., Portland, Ore.

C-3 Crocker-Wheeler Co..... 12
Crossley Bldg., 618 Mission St., San Francisco; 228 Central Avenue, Los Angeles.

C-4 Cutler-Hammer Manufacturing Co..... 579 Howard St., San Francisco; Morgan Bldg., Portland, Ore.; San Fernando Bldg., Los Angeles.

D-4 Davis Slate & Manufacturing Co..... Chicago, Ill.

D-2 Dearborn Drug and Chemical Works..... 11
355 East Second St., Los Angeles; 301 Front St., San Francisco.

E-7 Economy Fuse & Mfg. Co..... Kinzie and Orleans Sts., Chicago.

E-1 Edison Lamp Works of General Electric Co..... Rialto Bldg., San Francisco; 724 So. Spring St., Los Angeles.

E-2 Edison Storage Battery Supply Co..... 11
441 Golden Gate Ave., San Francisco.

E-3 Electric Agencies Co..... 247 Minna Street, San Francisco; Central Building, Los Angeles.

E-6 Electric Novelty Works..... 533 Mission St., San Francisco.

E-4 Electric Storage Battery Co..... 743 Rialto Bldg., San Francisco.

E-5 Electric, Railway & Manufacturing Supply Co..... 11
34 Second St., San Francisco.

F-1 Fairbanks, Morse & Co..... Los Angeles; Portland; 651 Mission St., San Francisco; Seattle; Spokane.

F-3 Federal Sign System (Electric)..... 618 Mission St., San Francisco.

G-1 General Electric Co..... 10
724 So. Spring St., Los Angeles; Worcester Bldg., Portland; Rialto Bldg., San Francisco; Colman Bldg., Seattle; Paulsen Bldg., Spokane.

G-1 General Vehicle Co..... 1117 Van Ness Ave., San Francisco; 331 Wall St., Los Angeles; British Columbia Electric Ry., Ltd., Vancouver, B. C.

H-1 Habirshaw Wire Co..... 12
(See Western Electric Company.)

H-2 Hemingray Glass Co..... 11
236-240 So. Los Angeles St., Los Angeles; 345 Oak St., Portland; 807 Mission St., San Francisco.

H-5 Hunt, Mirk & Co..... 141 Second St., San Francisco.

H-7 Hurley Machine Co..... New York and Chicago. (See Pacific States Electric Co.

I-2 Illinois Electric Co..... 261-263 So. Los Angeles St., Los Angeles.

I-3 Interstate Electric Novelty Co..... 111 New Montgomery St., San Francisco.

L-1 Leahy Manufacturing Co..... Eighth and Alameda St., Los Angeles.

L-2 Locke Insulator Manufacturing Co..... 4
(See Pierson, Roeding & Co.)

M-2 McGlauflin Manufacturing Co..... Sunnyvale, Cal.

M-4 Morse Chain Company..... Monadnock Bldg., San Francisco.

M-3 Moore & Co., Charles C..... 3
Van Nuys Bldg., Los Angeles; Spalding Bldg., Portland; Kearns Bldg., Salt Lake City; Sheldon Bldg., San Francisco; Mutual Life Bldg., Seattle; Santa Rita Hotel Bldg., Tucson.

N-1 Nason & Co., R. N..... 151 Potrero Ave., San Francisco.

N-6 National Carbon Company..... Cleveland, Ohio.

N-2 National Conduit & Cable Co., The..... Trust and Savings Bldg., Los Angeles; Rialto Bldg., San Francisco.

N-3 National Lamp Works of G. E. Co..... 5
(All Jobbers.)

N-4 New York Insulated Wire Co..... 629 Howard St., San Francisco.

N-5 Northwestern Pacific Railroad..... 808 Phelan Bldg., San Francisco.

O-1 Okonite Co. (The)..... 12
(All Jobbers.)

P-1 Pacific Electric Manufacturing Co..... 80 Tehama St., San Francisco.

P-2 Pacific States Electric Co..... 2
236-240 So. Los Angeles St., Los Angeles; 61-67 Fifth St. No., Portland; 200-210 Twelfth St., Oakland; 575 Mission St., San Francisco; 307 First Ave. So., Seattle.

P-4 Pelton Water Wheel Co..... 11
2219 Harrison St., San Francisco.

P-5 Pierson, Roeding & Co..... 4
Pacific Electric Bldg., Los Angeles; Rialto Bldg., San Francisco; Colman Bldg., Seattle.

P-6 Pittsburgh Electric Specialties Company..... 3
202 Aronson Bldg., San Francisco.

P-7 Pittsburgh Piping & Equipment Co..... 12
Monadnock Bldg., San Francisco.

S-1 Schaw-Batcher Company, Pipe Works, The..... 211 J St., Sacramento; 356 Market St., San Francisco.

S-4 Southern Pacific Co..... 2
Flood Bldg., San Francisco.

S-5 Sprague Electric Works..... 11
Rialto Bldg., San Francisco; Colman Bldg., Seattle; Corporation Bldg., Los Angeles; Electric Bldg., Portland; Paulsen Bldg., Spokane.

S-6 Standard Underground Cable Co..... First National Bank Bldg., San Francisco; Hibernian Bldg., Los Angeles; Yeon Bldg., Portland; Central Bldg., Seattle, Wash.

T-1 Thomas & Co., R..... 5
Pacific States Electric Co. and Western Electric Co., Pacific Coast Representatives.

T-2 Tubular Woven Fabric Company..... Pawtucket, R I.

U-1 Union Sheet Metal Works..... 575 Howard St., San Francisco.

W-1 Wagner Electric Manufacturing Company..... 3
St. Louis, Mo.

W-2 Western Electric Co..... 12
Eighth and Santee Sts., Los Angeles; 1901 Telegraph Ave., Oakland, Cal.; 680 Folsom St., San Francisco; 907 First Ave., Seattle; 45 North Fifth St., Portland, Ore.

W-4 Westinghouse Electric and Manufacturing Co..... 6
50-52 East Broadway, Butte; Van Nuys Bldg., Los Angeles; Couch Bldg., Portland; 212 So. W. Temple, Salt Lake City; 165 Second St., San Francisco; Second and Cherry Sts., Seattle; Paulsen Bldg., Spokane.

W-5 Westinghouse Machine Co..... 141 Second St., San Francisco.

W-6 Westinghouse Lamp Co..... (See Westinghouse Electric & Manufacturing Co.)

W-8 Western Pipe & Steel Co..... 444 Market St., San Francisco; 1758 North Broadway, Los Angeles.